AMENDMENTS TO THE CLAIMS

The following listing of claims replaces all prior versions of the claims in the Application. With reference to the listing it is noted that, herewith, claim 76 is amended. No new matter has been added.

Listing of Claims

Claim 1 (canceled).

Claim 2 (canceled).

Claim 3 (previously presented): A signal processing apparatus for processing an image signal comprising:

a hue difference detector for detecting a hue difference between adjoining pixels; and

luminance edge enhancement means for enhancing an edge pixel in an image by amplifying an edge luminance signal by a gain determined on the basis of the hue difference detected by said hue difference detector, wherein said hue difference detector includes: hue angle acquisition means for acquiring a hue angle of each pixel; a subtractor for obtaining a hue angle difference between adjoining pixels; and diffusion means for diffusing the hue angle difference.

Claim 4 (original): The signal processing apparatus according to claim 3, wherein said subtractor obtains hue angle differences between a pixel of interest and its adjoining pixels in the horizontal and vertical directions, and the hue angle difference of the pixel of interest is obtained by adding the hue angle differences in the horizontal and vertical directions.

Claim 5 (original): The signal processing apparatus according to claim 3, wherein said subtractor obtains a hue angle difference between a pixel of interest and its adjoining pixel in the oblique direction.

Claim 6 (original): The signal processing apparatus according to claim 3, wherein said diffusion means compares an absolute value of the hue angle difference between pixels of interest to an absolute value of the hue angle difference between neighbor pixels, and performs the diffusion when the absolute value of the hue angle difference between the pixels of interest is greater than the absolute value of the hue angle difference between the neighbor pixels.

Claim 7 (original): The signal processing apparatus according to claim 3, wherein said hue angle difference acquisition means calculates the hue angle using a color difference signal.

Claim 8 (withdrawn): A signal processing apparatus for processing an image signal comprising: a hue difference detector for detecting a hue difference between adjoining pixels; a plurality of luminance signal generators for generating a plurality of luminance signals by applying different processing on an input luminance signal; a selector for selecting one of the plurality of luminance signals on the basis of the hue difference detected by said hue difference detector; and a processor for applying a predetermined signal process on the luminance signal selected by said selector.

Claim 9 (withdrawn): The signal processing apparatus according to claim 8, wherein said plurality of luminance signal generators include a first generator for generating a first luminance signal and a second generator for generating a second luminance signal, and said selector outputs the first luminance signal when the hue difference detected by said hue

difference detector is less than or equal to a predetermined value and outputs the second luminance signal when the hue difference is greater than the predetermined value.

Claim 10 (withdrawn): The signal processing apparatus according to claim 9, wherein said first generator generates the first luminance signal on the basis of a plurality of color signals outputted from an image sensing element.

Claim 11 (withdrawn): The signal processing apparatus according to claim 9, wherein said second generator applies adaptive interpolation to green signals to generate a luminance signal, and replaces a low frequency component of the interpolated luminance signal with a low frequency component of the first luminance signal to generate the second luminance signal.

Claim 12 (withdrawn): The signal processing apparatus according to claim 11, wherein said second generator includes: an adaptive interpolator; a high pass filter for extracting a high frequency component of an output signal from said adaptive interpolator; a low pass filter for extracting a low frequency component of an output signal from said first generator; and an adder for adding an output signal from said high pass filter and an output signal from said low pass filter.

Claim 13 (withdrawn): The signal processing apparatus according to claim 9, wherein said first and second generators respectively generates said first and second luminance signals by sampling the image signal at spatial frequencies different from each other.

Claim 14 (withdrawn): The signal processing apparatus according to claim 13, wherein said second generator samples the image signal to generate the second luminance signal at a lower spatial frequency than a spatial frequency used by said first generator.

Claim 15 (withdrawn): The signal processing apparatus according to claim 9, wherein said first and second generators respectively generate the first and second luminance signals by different ratios of color components of the image signal from each other.

Claim 16 (withdrawn): The signal processing apparatus according to claim 9, wherein said second generator generates the second luminance signal by using a less number of color components of the image signal than a number of color components used by said first generator to generate the first luminance signal.

Claim 17 (withdrawn): The signal processing apparatus according to claim 8, wherein said hue difference detector includes: hue angle acquisition means for acquiring a hue angle of each pixel; a subtractor for obtaining a hue angle difference between adjoining pixels; and diffusion means for diffusing the hue angle difference.

Claim 18 (withdrawn): The signal processing apparatus according to claim 17, wherein said subtractor obtains hue angle differences between a pixel of interest and its adjoining pixels in the horizontal and vertical directions, and the hue angle difference of the pixel of interest is obtained by adding the hue angle differences in the horizontal and vertical directions.

Claim 19 (withdrawn): The signal processing apparatus according to claim 17, wherein said subtractor obtains a hue angle difference between a pixel of interest and its adjoining pixel in the oblique direction.

Claim 20 (withdrawn): The signal processing apparatus according to claim 17, wherein said diffusion means compares an absolute value of the hue angle difference between pixels of interest to an absolute value of the hue angle difference between neighbor pixels, and performs the diffusion when the absolute value of the hue angle difference between

the pixels of interest is greater than the absolute value of the hue angle difference between the neighbor pixels.

Claim 21 (withdrawn): The signal processing apparatus according to claim 17, wherein said hue angle difference acquisition means calculates the hue angle using a color difference signal.

Claim 22 (withdrawn): A signal processing apparatus for processing an image signal comprising: a hue difference detector for detecting a hue difference between adjoining pixels; a plurality of luminance signal generators for generating a plurality of luminance signals by applying different processing on an input luminance signal; operation means for operating the plurality of luminance signals using a value obtained on the basis of the hue difference detected by said hue difference detector and outputting an operation result; and a processor for applying a predetermined signal process on the operation result outputted from said operation means.

Claim 23 (withdrawn): The signal processing apparatus according to claim 22, wherein said plurality of luminance signal generators include a first generator for generating a first luminance signal and a second generator for generating a second luminance signal, and said operation means obtains a first and second coefficients on the basis of the hue difference, multiplies the first luminance signal by the first coefficient, multiplies the second luminance signal by the second coefficient, and adds the products.

Claim 24 (withdrawn): The signal processing apparatus according to claim 23, wherein a sum of the first and second coefficients are constant.

Claim 25 (withdrawn): The signal processing apparatus according to claim 23, wherein said first generator generates the first luminance signal on the basis of a plurality of color signals outputted from an image sensing element.

Claim 26 (withdrawn): The signal processing apparatus according to claim 23, wherein said second generator applies adaptive interpolation to green signals to generate a luminance signal, and replaces a low frequency component of the interpolated luminance signal with a low frequency component of the first luminance signal to generate the second luminance signal.

Claim 27 (withdrawn): The signal processing apparatus according to claim 26, wherein said second generator includes: an adaptive interpolator; a high pass filter for extracting a high frequency component of an output signal from said adaptive interpolator; a low pass filter for extracting a low frequency component of an output signal from said first generator; and an adder for adding an output signal from said high pass filter and an output signal from said low pass filter.

Claim 28 (withdrawn): The signal processing apparatus according to claim 23, wherein said first and second generators respectively generates said first and second luminance signals by sampling the image signal at spatial frequencies different from each other.

Claim 29 (withdrawn): The signal processing apparatus according to claim 28, wherein said second generator samples the image signal to generate the second luminance signal at a lower spatial frequency than a spatial frequency used by said first generator.

Claim 30 (withdrawn): The signal processing apparatus according to claim 23, wherein said first and second generators respectively generate the first and second luminance signals by different ratios of color components of the image signal from each other.

Claim 31 (withdrawn): The signal processing apparatus according to claim 23, wherein said second generator generates the second luminance signal by using a less number of color components of the image signal than a number of color components used by said first generator to generate the first luminance signal.

Claim 32 (withdrawn): The signal processing apparatus according to claim 22, wherein said hue difference detector includes: hue angle acquisition means for acquiring a hue angle of each pixel; a subtractor for obtaining a hue angle difference between adjoining pixels; and diffusion means for diffusing the hue angle difference.

Claim 33 (withdrawn): The signal processing apparatus according to claim 32, wherein said subtractor obtains hue angle differences between a pixel of interest and its adjoining pixels in the horizontal and vertical directions, and the hue angle difference of the pixel of interest is obtained by adding the hue angle differences in the horizontal and vertical directions.

Claim 34 (withdrawn): The signal processing apparatus according to claim 32, wherein said subtractor obtains a hue angle difference between a pixel of interest and its adjoining pixel in the oblique direction.

Claim 35 (withdrawn): The signal processing apparatus according to claim 32, wherein said diffusion means compares an absolute value of the hue angle difference between pixels of interest to an absolute value of the hue angle difference between neighbor pixels, and performs the diffusion when the absolute value of the hue angle difference between the pixels of interest is greater than the absolute value of the hue angle difference between the neighbor pixels.

Claim 36 (withdrawn): The signal processing apparatus according to claim 32, wherein said hue angle difference acquisition means calculates the hue angle using a color difference signal.

Claim 37 (canceled).

Claim 38 (canceled).

Claim 39 (previously presented): A signal processing method for processing an image signal comprising:

a hue difference detection step of detecting a hue difference between adjoining pixels; and

a luminance edge enhancement step of enhancing an edge pixel in an image by amplifying an edge luminance signal by a gain determined on the basis of the hue difference detected at said hue difference detection step, wherein said hue difference detection step includes: a hue angle acquisition step of acquiring a hue angle of each pixel; a subtracting step of obtaining a hue angle difference between adjoining pixels; and a diffusion step of diffusing the hue angle difference.

Claim 40 (original): The signal processing method according to claim 39, wherein said subtraction step comprises: a step of obtaining a hue angle difference between a pixel of interest and its adjoining pixel in the horizontal direction; a step of obtaining a hue angle difference between the pixel of interest and its adjoining pixel in the vertical direction; and a step of adding the hue angle differences in the horizontal and vertical directions.

Claim 41 (original): The signal processing method according to claim 39, wherein, in said subtraction step, a hue angle difference between a pixel of interest and its adjoining pixel in the oblique direction is obtained.

Claim 42 (original): The signal processing method according to claim 39, wherein, in said diffusion step, an absolute value of the hue angle difference between pixels of interest is compared to an absolute value of the hue angle difference of neighbor pixels, and when the absolute value of the hue angle difference of the pixels of interest is greater than the absolute value of the hue angle difference of the neighbor pixels, the diffusion is performed.

Claim 43 (original): The signal processing method according to claim 39, wherein, in said hue angle difference acquisition step, the hue angle is calculated using a color difference signal.

Claim 44 (withdrawn): A signal processing method for processing an image signal comprising: a hue difference detection step of detecting a hue difference between adjoining pixels; a plurality of luminance signal generation steps of generating a plurality of luminance signals by applying different processing on an input luminance signal; a selection step of selecting one of the plurality of luminance signals on the basis of the hue difference detected in said hue difference detection step; and a processing step of applying a predetermined signal process on the luminance signal selected in said selection step.

Claim 45 (withdrawn): The signal processing method according to claim 44, wherein said plurality of luminance signal generation steps include a first generation step of generating a first luminance signal and a second generation step of generating a second luminance signal, and in said selection step, the first luminance signal is outputted when the hue difference detected in said hue difference detection step is less than or equal to a predetermined value and the second luminance signal is outputted when the hue difference is greater than the predetermined value.

Claim 46 (withdrawn): The signal processing method according to claim 45, wherein, in said first generation step, the first luminance signal is generated on the basis of a plurality of color signals outputted from an image sensing element.

Claim 47 (withdrawn): The signal processing method according to claim 45, wherein, in said second generation step, adaptive interpolation is applied to green signals to generate a luminance signal, and a low frequency component of the interpolated luminance signal is replaced by a low frequency component of the first luminance signal to generate the second luminance signal.

Claim 48 (withdrawn): The signal processing method according to claim 47, wherein said second generation step includes: an adaptive interpolation step; a high pass filtering step of extracting a high frequency component of an output signal obtained in said adaptive interpolation step; a low pass filtering step of extracting a low frequency component of an output signal obtained in said first generation step; and an addition step of adding a signal outputted in said high pass filtering step and a signal outputted in said low pass filtering step.

Claim 49 (withdrawn): The signal processing method according to claim 45, wherein, in said first and second generation steps, said first and second luminance signals are respectively generated by sampling the image signal at spatial frequencies different from each other.

Claim 50 (withdrawn): The signal processing method according to claim 49, wherein, in said second generation step, the image signal is sampled to generate the second luminance signal at a lower spatial frequency than a spatial frequency used in said first generation step.

Claim 51 (withdrawn): The signal processing method according to claim 45, wherein, in said first and second generation steps, the first and second luminance signals are respectively generated by different ratios of color components of the image signal from each other.

Claim 52 (withdrawn): The signal processing method according to claim 45, wherein, in said second generation step, the second luminance signal is generated by using a less number of color components of the image signal than a number of color components used in said first generation step to generate the first luminance signal.

Claim 53 (withdrawn): The signal processing method according to claim 44, wherein said hue difference detection step includes: a hue angle acquisition step of acquiring a hue angle of each pixel; a subtracting step of obtaining a hue angle difference between adjoining pixels; and a diffusion step of diffusing the hue angle difference.

Claim 54 (withdrawn): The signal processing method according to claim 53, wherein said subtraction step comprises: a step of obtaining a hue angle difference between a pixel of interest and its adjoining pixel in the horizontal direction; a step of obtaining a hue angle difference between the pixel of interest and its adjoining pixel in the vertical direction; and a step of adding the hue angle differences in the horizontal and vertical directions.

Claim 55 (withdrawn): The signal processing method according to claim 53, wherein, in said subtraction step, a hue angle difference between a pixel of interest and its adjoining pixel in the oblique direction is obtained.

Claim 56 (withdrawn): The signal processing method according to claim 53, wherein, in said diffusion step, an absolute value of the hue angle difference between pixels of interest is compared to an absolute value of the hue angle difference of neighbor pixels, and

when the absolute value of the hue angle difference of the pixels of interest is greater than the absolute value of the hue angle difference of the neighbor pixels, the diffusion is performed.

Claim 57 (withdrawn): The signal processing method according to claim 53, wherein, in said hue angle difference acquisition step, the hue angle is calculated using a color difference signal.

Claim 58 (withdrawn): A signal processing method for processing an image signal comprising: a hue difference detection step of detecting a hue difference between adjoining pixels; a plurality of luminance signal generation steps of generating a plurality of luminance signals by applying different processing on an input luminance signal; an operation step of operating the plurality of luminance signals using a value obtained on the basis of the hue difference detected in said hue difference detection steps and outputting an operation result; and a processing step of applying a predetermined signal process on the operation result outputted in said operation step.

Claim 59 (withdrawn): The signal processing method according to claim 58, wherein said plurality of luminance signal generation steps include a first generation step of generating a first luminance signal and a second generation step of generating a second luminance signal, and said operation step comprises: a step of acquiring a first and second coefficients on the basis of the hue difference; a step of multiplying the first luminance signal by the first coefficient; a step of multiplying the second luminance signal by the second coefficient; and a step of adding the products.

Claim 60 (withdrawn): The signal processing method according to claim 59, wherein a sum of the first and second coefficients are constant.

Claim 61 (withdrawn): The signal processing method according to claim 59, wherein, in said first generation step, the first luminance signal is generated on the basis of a plurality of color signals outputted from an image sensing element.

Claim 62 (withdrawn): The signal processing method according to claim 59, wherein, in said second generation step, adaptive interpolation is applied to green signals to generate a luminance signal, and a low frequency component of the interpolated luminance signal is replaced by a low frequency component of the first luminance signal to generate the second luminance signal.

Claim 63 (withdrawn): The signal processing method according to claim 62, wherein said second generation step includes: an adaptive interpolation step; a high pass filtering step of extracting a high frequency component of an output signal obtained in said adaptive interpolation step; a low pass filtering step of extracting a low frequency component of an output signal obtained in said first generation step; and an addition step of adding a signal outputted in said high pass filtering step and a signal outputted in said low pass filtering step.

Claim 64 (withdrawn): The signal processing method according to claim 59, wherein, in said first and second generation steps, said first and second luminance signals are respectively generated by sampling the image signal at spatial frequencies different from each other.

Claim 65 (withdrawn): The signal processing method according to claim 64, wherein, in said second generation step, the image signal is sampled to generate the second luminance signal at a lower spatial frequency than a spatial frequency used in said first generation step.

Claim 66 (withdrawn): The signal processing method according to claim 59, wherein, in said first and second generation steps, the first and second luminance signals are respectively generated by different ratios of color components of the image signal from each other.

Claim 67 (withdrawn): The signal processing method according to claim 59, wherein, in said second generation step, the second luminance signal is generated by using a less number of color components of the image signal than a number of color components used in said first generation step to generate the first luminance signal.

Claim 68 (withdrawn): The signal processing method according to claim 58, wherein said hue difference detection step includes: a hue angle acquisition step of acquiring a hue angle of each pixel; a subtracting step of obtaining a hue angle difference between adjoining pixels; and a diffusion step of diffusing the hue angle difference.

Claim 69 (withdrawn): The signal processing method according to claim 68, wherein said subtraction step comprises: a step of obtaining a hue angle difference between a pixel of interest and its adjoining pixel in the horizontal direction; a step of obtaining a hue angle difference between the pixel of interest and its adjoining pixel in the vertical direction; and a step of adding the hue angle differences in the horizontal and vertical directions.

Claim 70 (withdrawn): The signal processing method according to claim 68, wherein, in said subtraction step, a hue angle difference between a pixel of interest and its adjoining pixel in the oblique direction is obtained.

Claim 71 (withdrawn): The signal processing method according to claim 68, wherein, in said diffusion step, an absolute value of the hue angle difference between pixels of interest is compared to an absolute value of the hue angle difference of neighbor pixels, and

when the absolute value of the hue angle difference of the pixels of interest is greater than the absolute value of the hue angle difference of the neighbor pixels, the diffusion is performed.

Claim 72 (withdrawn): The signal processing method according to claim 68, wherein, in said hue angle difference acquisition step, the hue angle is calculated using a color difference signal.

Claim 73 (previously presented): An image sensing apparatus comprising a signal processing apparatus of claim 3.

Claim 74 (withdrawn): An image sensing apparatus comprising a signal processing apparatus of claim 8.

Claim 75 (withdrawn): An image sensing apparatus comprising a signal processing apparatus of claim 22.

Claim 76 (currently amended): A computer program product for reducing jaggedness on color image edges comprising a computer ~~usable~~ readable medium having computer readable program code means embodied in said medium for a signal processing method for processing an image signal, said computer program product including:

first computer readable program code means for detecting a hue difference between adjoining pixels; and

second computer readable program code means for enhancing an edge pixel in an image by controlling an edge luminance signal by a gain determined on the basis of the detected hue difference,

wherein said first computer readable program code means includes:

third computer readable program code means for acquiring a hue angle of each pixel;

fourth computer readable program code means for obtaining a hue angle difference between adjoining pixels; and

fifth computer readable program code means for diffusing the hue angle difference,

whereby the jaggedness on color image edges is reduced.

Claim 77 (withdrawn): A computer program product comprising a computer usable medium having computer readable program code means embodied in said medium for a signal processing method for processing an image signal said product including: first computer readable program code means for detecting a hue difference between adjoining pixels; second computer readable program code means for generating a plurality of luminance signals by applying different processing on an input luminance signal; third computer readable program code means for selecting one of the plurality of luminance signals on the basis of the detected hue difference; and fourth computer readable program code means for applying a predetermined signal process on the selected luminance signal.

Claim 78 (withdrawn): A computer program product comprising a computer usable medium having computer readable program code means embodied in said medium for a signal processing method for processing an image signal said product including: first computer readable program code means for detecting a hue difference between adjoining pixels; second computer readable program code means for generating a plurality of luminance signals by applying different processing on an input luminance signal; third computer readable program code means for operating the plurality of luminance signals using a value obtained on the basis of the detected hue difference and outputting an operation result; and fourth applying a predetermined signal process on the outputted operation result.